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rarely on other parts of their tongue. The insects in the list are marked m. l. or t. according as the pollen masses were found on the maxillary or labial palpi, or on the ligula proper.

Visitors: (June 21, 25) Hymenoptera—*Apidae*: (1) *Apis mellifica* L. ♀, l.; (2) *Coelioxys* 8-dentata Say ♂♀; (3) *Stelis lateralis* Cr. ♀; (4) *Nomada articulata* Sm. ♂, m. l.; (5) *N. incerta* Cr. ♀, m. l.; *Andrenidae*: (6) *Macropis steironemæ* Rob. (MS) ♂♀; (7) *Agapostemon radiatus* Say ♀, m.; (8) *Augochlora lucidula* Sm. ♀; (9) *Halictus fasciatus* Nyl. ♀; (10) *H. connexus* Cr. ♂♀; (11) *Colletes* sp. ♂, m.; (12) *Prosopis affinis* Sm. ♀; *Eumenidae*: (13) *Odynerus foraminatus* Sauss. t.; *Bembecidae*: (14) *Monedula ventralis* Say; *Larridae*: (15) *Astata bicolor* Say; *Sphecidae*: (16) *Ammophila vulgaris* Cr.; (17) *Isodontia philadelphica* St. Farg., t.; (18) *Priononyx thomæ* F.; (19) *P. atrata* St. Farg.

Diptera—*Mycetophilidae*: (20) *Sciara* sp.; *Bombyliidae*: (21) *Anthrax alternata* Say; *Syrphidae*: (22) *Allograpta obliqua* Say; (23) *Sphærophoria cylindrica* Say; (24) *Tropidia mamillata* Lw.; (25) *T. quadrata* Say; *Empidae*: (26) *Empis* sp.; *Tachinidae*: (27) *Cistogaster divisa* Lw.; (28) *Ocyptera* sp.; (29) *Jurinia apicifera* Walk.; (30) *Micropalpus* sp.; (31) *Acroglossa hesperidarum* Will.; *Sarcophagidae*: (32) *Sarcophaga* sp.; *Muscidae*: (33) *Lucilia caesar* L.; (34) *L. macellaria* F.; *Anthomyidae*: (35) *Anthomyia* sp.; (36) *Limnophora* sp.

Lepidoptera—*Rhopalocera*: (37) *Argynnis cybele* F.; (38) *Thecla calanus* Hübn.

Coleoptera—*Scarabacidae*: (39) *Trichius piger* F.

Hemiptera—*Capsidae*: (40) *Lygus pratensis* L.; *Lygaeidae*: (41) *Lygæus turcicus* F., s.

*Carlinville, Ill.*

## Notes on technique. II.

JAMES ELLIS HUMPHREY.

In the study of zoöspores, especially those of Fungi, it is not always easy to demonstrate clearly the number and attachment of the cilia. The iodine preparations usually recommended for that purpose have not proved satisfactory with me on account of their tendency to shrivel and distort the body of the

zoöspore. In some cases, too, they have not acted with sufficient promptness to fix the spore at precisely the right instant. In view of these facts attempts have been made to find a more satisfactory method of treatment, and I have adopted after numerous trials a combination somewhat different from any which I have seen suggested, though it involves nothing new in principle.

The zoöspores, in water under a supported cover-glass, are instantly killed by placing at the edge of the cover a couple of drops of a one per cent. solution of osmic acid. This is left for a few minutes to fix the spores thoroughly, which it does without the least distortion, and is then drawn off by means of filter-paper. It is not necessary to wholly remove the acid or to pass water under the cover before applying the staining fluid, which consists of a drop of a moderately strong solution in 90 per cent. alcohol of Hanstein's rosanilin-violet, composed of equal parts of fuchsin and methyl-violet. This stains the cilia and the bodies of the zoöspores of both Algae and Fungi very quickly and deeply, as well as sharply, showing the number and insertion of the cilia as plainly as a drawing, and giving a clear image with the camera lucida.

It is very possible that other stains would serve equally well, but I have not taken time nor has it seemed worth while to seek further in view of the uniformly good results obtained as described. For killing and fixing, I think there is nothing quite so good in all respects as osmic acid.

By means of the above treatment I have had no difficulty in demonstrating the correctness of the statements of Cornu<sup>1</sup> and Hartog<sup>2</sup> that the zoöspores of *Achlya* are ciliate, at least in some cases, when they escape from the zoösporangium, as are those of *Saprolegnia*. This statement is directly opposed to those of other writers and to those of the leading textbooks,<sup>3</sup> which state that the zoöspores of *Achlya* escape from the sporangium *without cilia*. My observations were made on a form related closely to *A. polyandra* (perhaps that species), and seem to me entirely conclusive. The discussion of the details of the structure of the zoöspores and of the bearings of the fact stated is reserved for a future occasion; but it

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<sup>1</sup>Ann. Sci. Nat. ser. 5, tom. xv, p. 1.

<sup>2</sup>Quart. Journ. Mic. Sci. vol. xxvii, p. 427.

<sup>3</sup>Cf. De Bary: *Vergl. Morphol. u. Biol. d. Pilze*, p. 116, and Engl. transl. p. 108; Zopf: *Die Pilze*, p. 294.

may be remarked here, as has been done by the previous writers, that the establishment of the diplanetism of *Achlya* brings it much closer to *Saprolegnia*. Indeed the structural differences between them become reduced to a single one; namely, that while in *Achlya* the sporangia formed from a filament arise after the first one by lateral outgrowth below the basal walls of the previous ones, in *Saprolegnia* they usually arise inside of the preceding ones by the upward growth of the successive basal walls. But I have seen, in an undetermined species of *Saprolegnia*, the formation of secondary sporangia after the *Achlya* type on a few filaments. There remain to be noticed two physiological differences so closely connected as to constitute, perhaps, a single phenomenon. The first swarming period in *Achlya* is reduced to its lowest terms, and at its close the zoöspores become aggregated into a hollow sphere at the mouth of the sporangium, in response to an apparent mutual attraction which Hartog<sup>1</sup> has termed adelphotaxy. Is this mutual attraction the cause of the shortness of the first swarming period?

*Amherst, Mass.*

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## A contribution to the life history of *Hydrastis Canadensis*.

HOMER BOWERS.

(WITH PLATE VIII.)

About ten years ago while engaged in the cultivation of various indigenous plants and the study of their germination and growth some deviations were observed in the behavior of *Hydrastis Canadensis* so at variance with the accepted view of the life history, that a minute study of all its peculiarities was begun and from that time to the present it has been followed with the view of bringing the facts to the attention of botanists.

My attention was first drawn to the plant specially, on discovering a stage in its growth concerning which no record exists. Afterwards when investigation disclosed that this unknown stage embraces a feature anomalous in the growth of plants, a great incentive for further research was added. This at length brought to light two other important facts

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<sup>1</sup>Annals of Botany, vol. ii, no. vi, p. 216.